United States Patent [19]

Takahashi

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[54] **APPARATUS FOR DETECTING WHETHER A REPLACEABLE CARTRIDGE IS NEW OR USED IN AN IMAGE FORMING APPARATUS**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**[5] **G03G 15/00**

[52] **U.S. Cl.** **355/208;** 355/245

[58] **Field of Search** 355/209, 208, 203, 245, 355/246, 260

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,956,668 9/1990 Arnold et al. 355/208

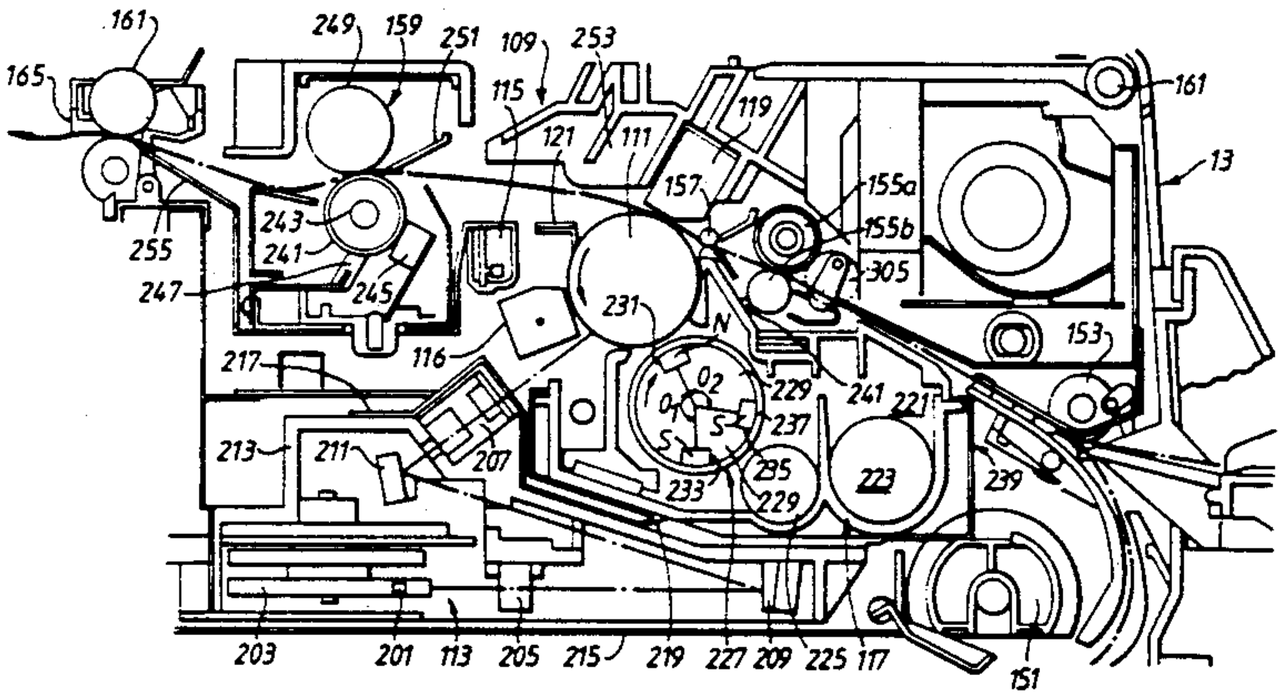
Primary Examiner—R. L. Moses

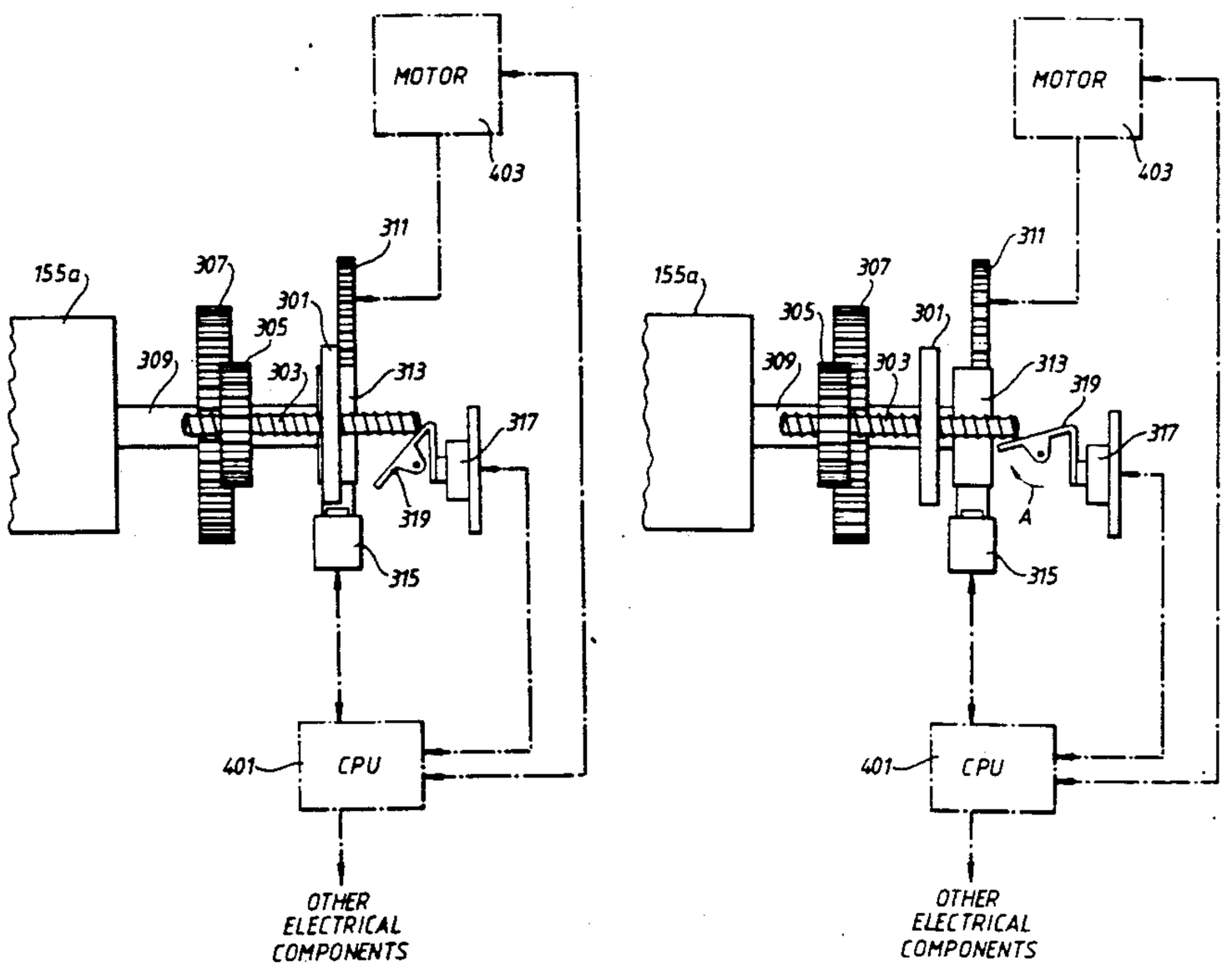
Attorney, Agent, or Firm—Banner, Birch, McKie & Beckett

[57] **ABSTRACT**

A laser printer includes a photosensitive drum, a developing device, a transferring device, and a fixing device. The photosensitive drum and the developing device are mounted along with a process cartridge within one body. The process cartridge is detachably inserted into the body. When the process cartridge is out of the body, the state of the process cartridge is treated as being "new". The state of the process cartridge is changed from the "new" state to a "used" state after an initializing operation of the process cartridge after it is completed and inserted into the body.

11 Claims, 7 Drawing Sheets





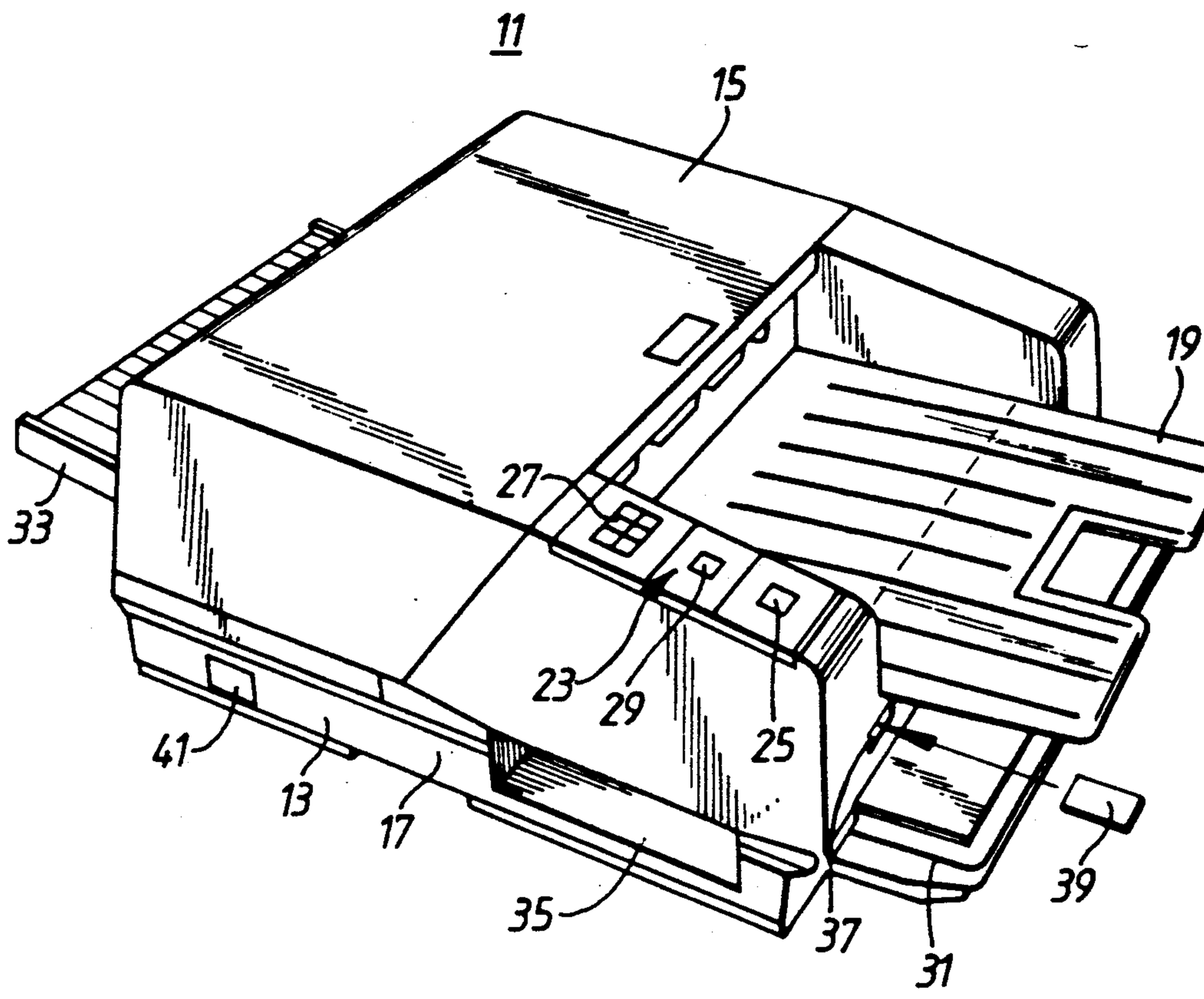


Fig.1.

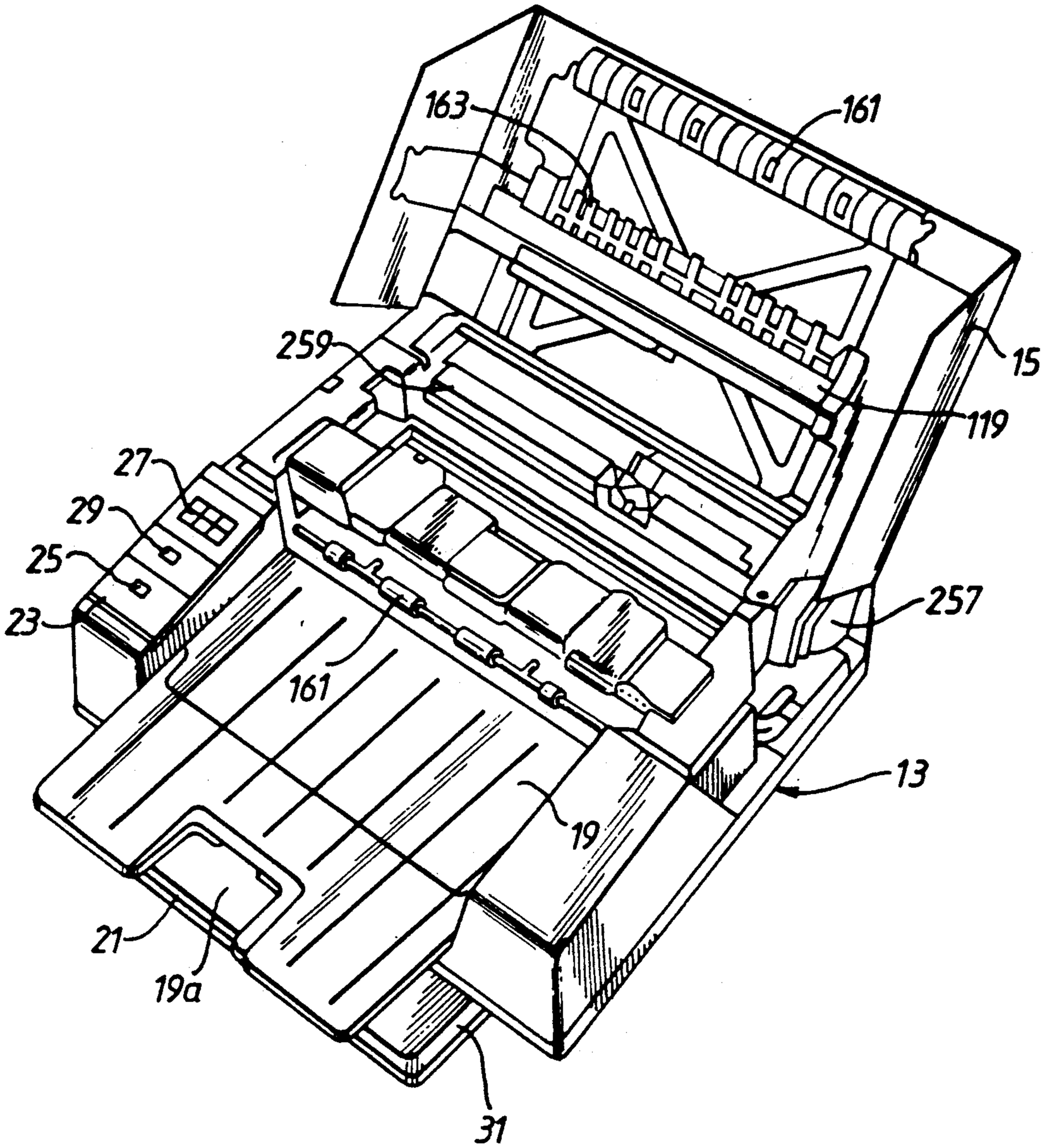


Fig.2.

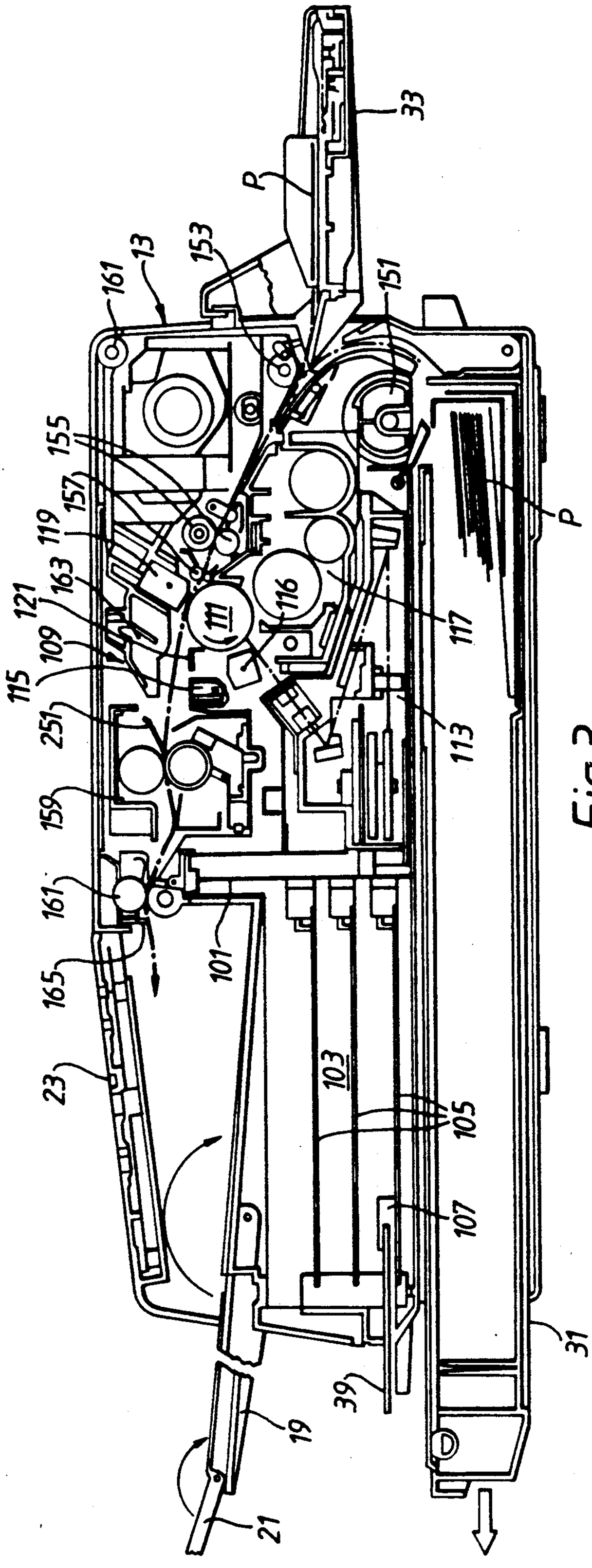

33
P
153
13
161
151
155
157
119
163
121
109
115
116
117
P
251
159
161
113
165
101
23
103
105
107
31
39
19
21

Fig.3

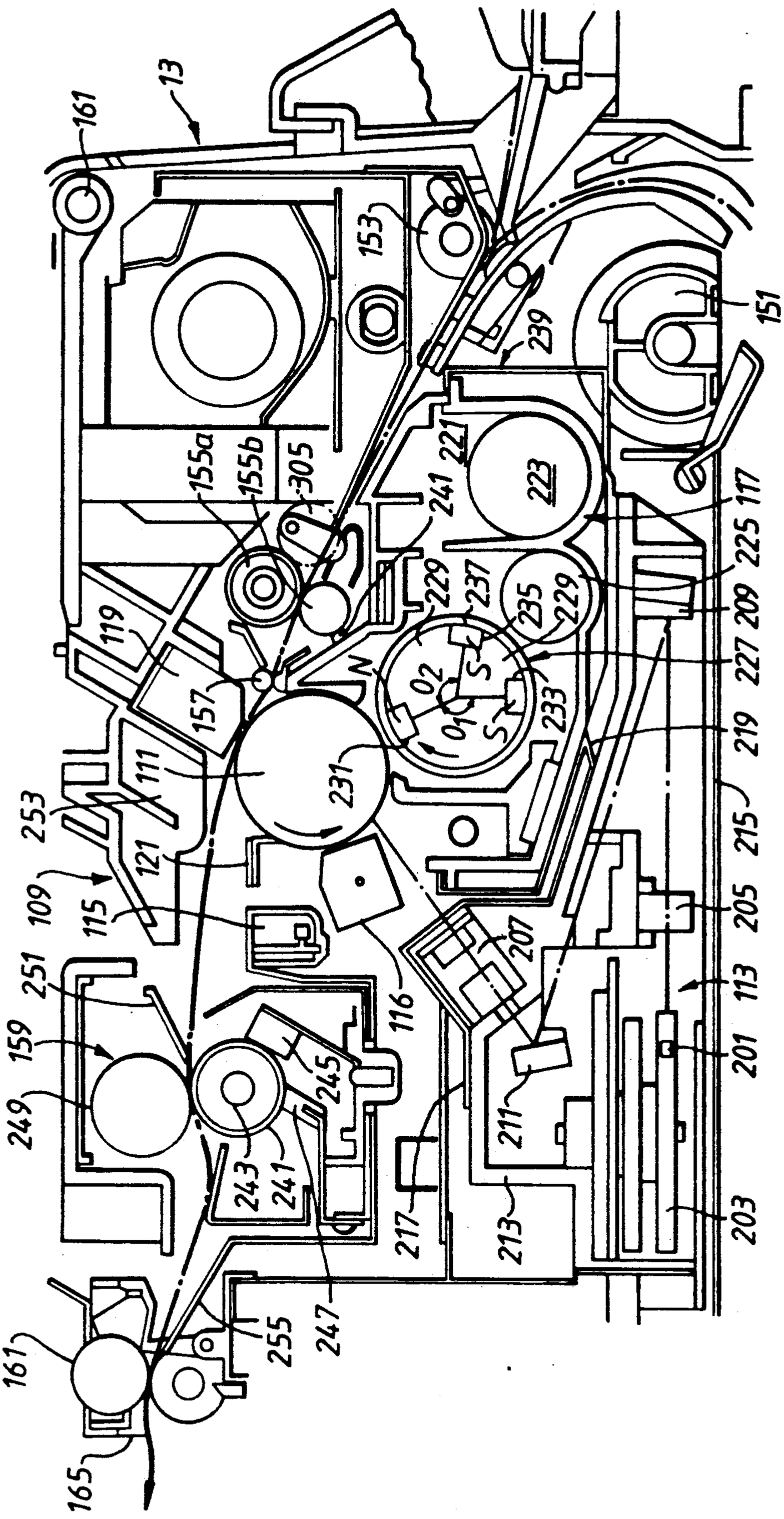

161
13
153
151
239
155a
155b
305
241
221
223
117
225
209
227
219
229
237
235
233
231
119
157
111
253
121
109
115
251
159
249
243
245
116
207
211
205
113
201
215
203
217
213
247
255
165

Fig. 4.

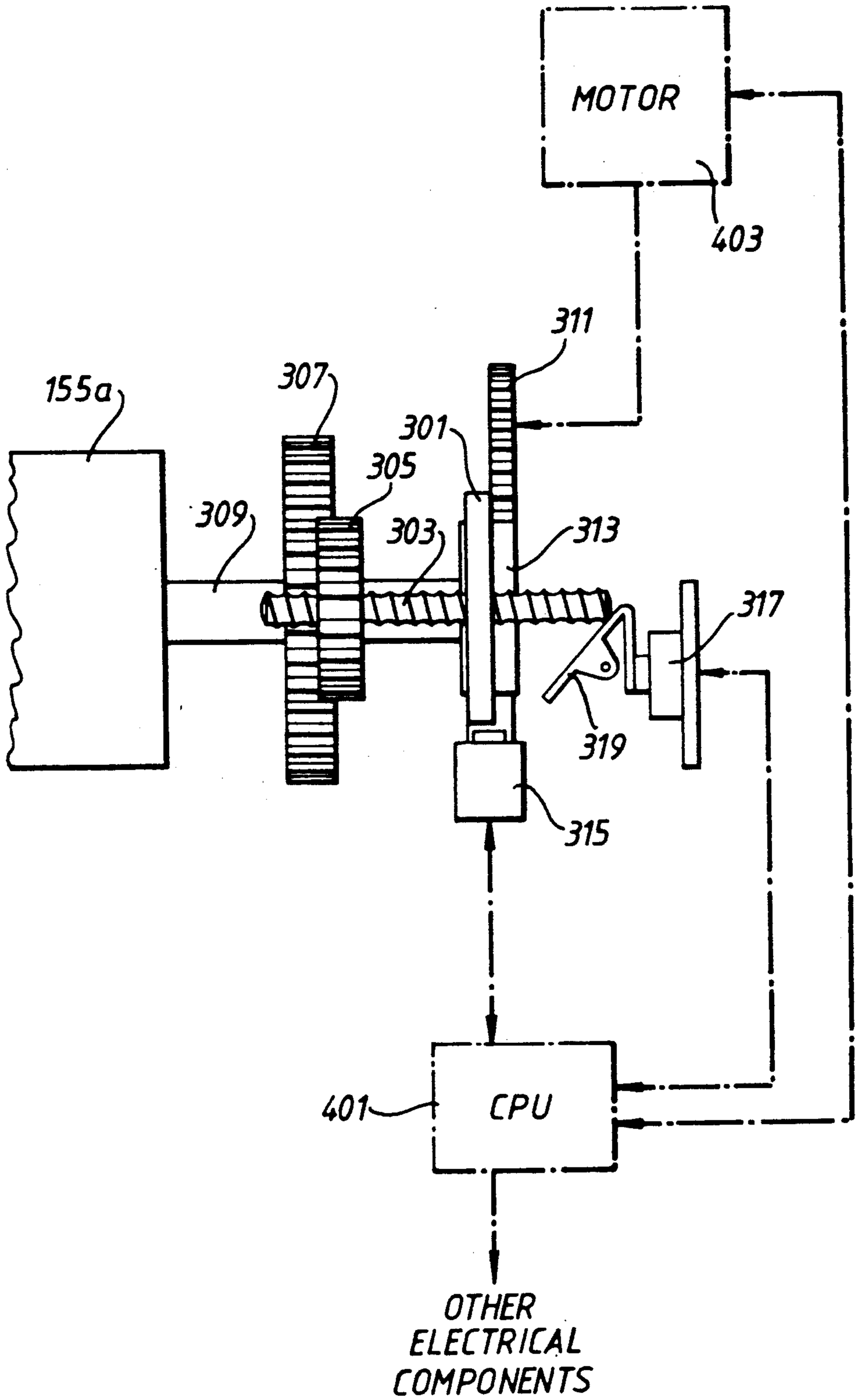

MOTOR
403
311
155a
307
301
305
309
303
313
317
319
315
401
CPU
OTHER
ELECTRICAL
COMPONENTS

Fig.5.

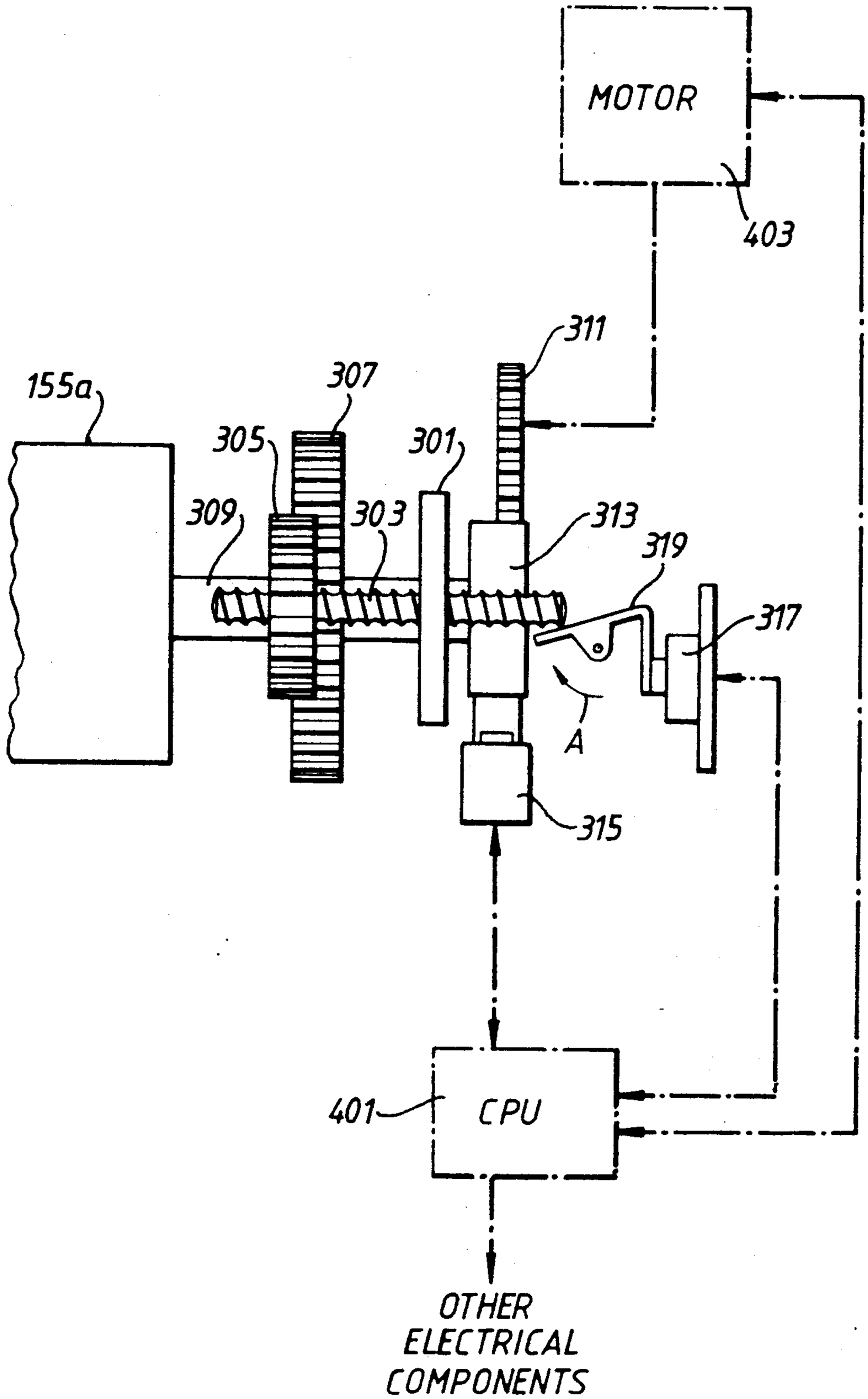

MOTOR
403
311
155a
307
305
301
309
303
313
319
317
A
315
401
CPU
OTHER
ELECTRICAL
COMPONENTS

Fig.6.

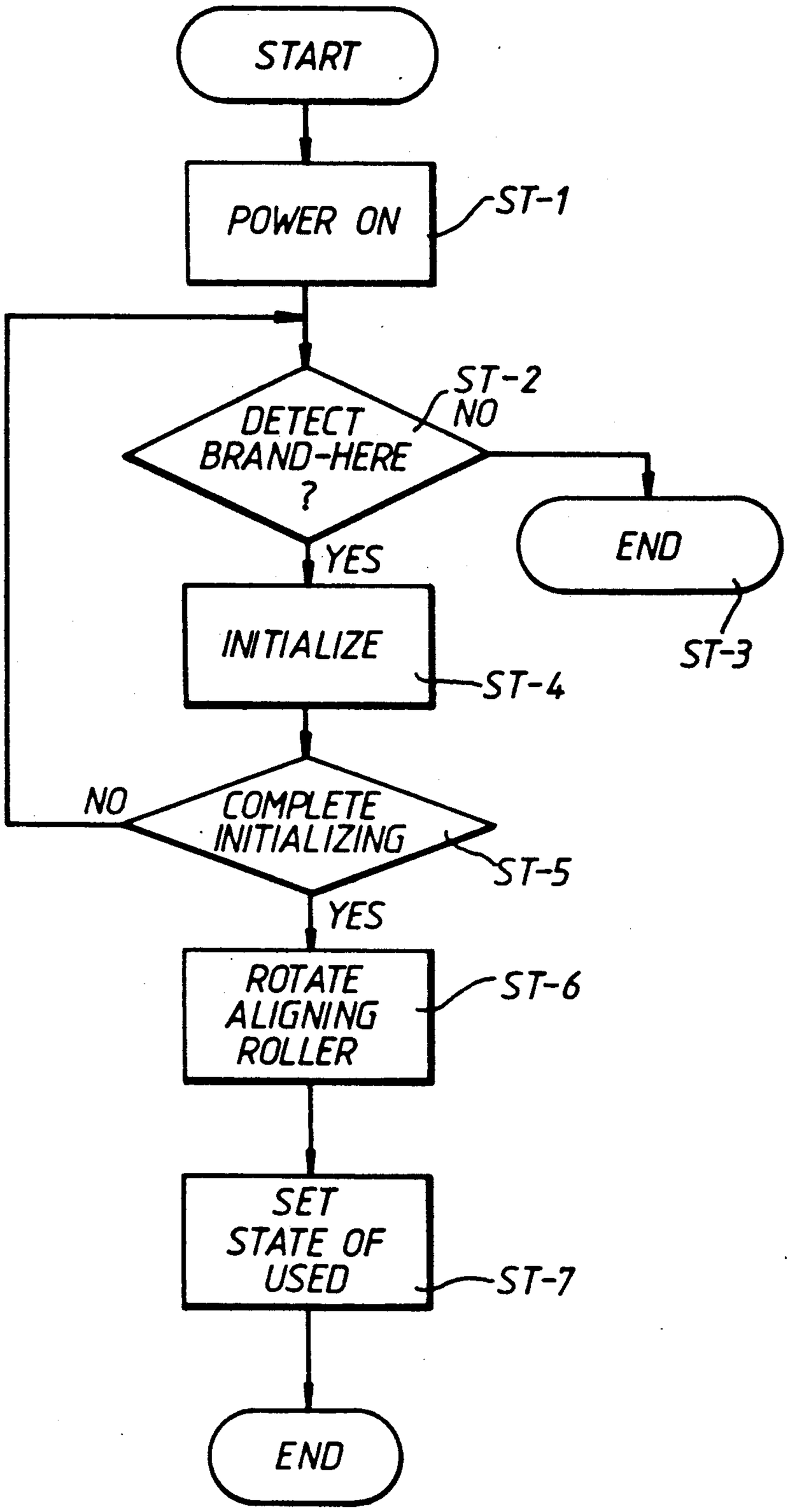

START
POWER ON
ST-1
DETECT BRAND-HERE ?
ST-2
NO
END
ST-3
YES
INITIALIZE
ST-4
NO
COMPLETE INITIALIZING
ST-5
YES
ROTATE ALIGNING ROLLER
ST-6
SET STATE OF USED
ST-7
END

Fig.7.

APPARATUS FOR DETECTING WHETHER A REPLACEABLE CARTRIDGE IS NEW OR USED IN AN IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to an image forming apparatus, and more particularly is directed to an image forming apparatus which automatically determines the state and condition of image forming elements within the apparatus. When necessary, the image forming elements are initialized to a desired state.

2. Description of the Related Art

An image forming apparatus, such as a copier or laser printer, employs electrophotographic image forming techniques. Using these techniques, a latent image is formed on a photosensitive drum. A developing device develops the latent image using a toner which makes the latent image visible. A problem arises, however, in that it is difficult to convey only the toner to the photosensitive drum during the developing process.

Thus, a toner carrier, such as a magnetic powder, is used which allows only the toner to be easily conveyed in order to form a high quality image. However, it is necessary to mix the toner and toner carriers together before forming the image.

The toner is consumed during every image formation so that it is necessary to re-supply the toner after a plurality of images are formed. As is well known, a toner sensor automatically detects the quantity of residual toner, i.e., the density of the toner, in the developing device. The toner sensor generates a signal indicating that toner density is equal to or less than a predetermined value. Thus, the image forming apparatus supplies toner to the developer in response to the density signal. It is important to determine the predetermined density value in order to adequately supply the toner. Usually, the predetermined value is determined on the basis of an initial value of toner density.

It is necessary to mix the toner and the toner carriers together in order to correctly measure the initial value. This is because the toner sensor measures toner density on the basis of the magnetic characteristic of the mixture of the toner and the toner carriers.

A conventional image forming apparatus performs an initial operation to mix together the toner and the toner carriers and to determine the initial value of toner density of the mixture.

The initial operation must be performed only when a new developing device is inserted into the image forming apparatus. This is due to variations in the characteristics of the mixture of toner and toner carriers which occur during storage of the mixture. Thus, the image forming apparatus performs the initializing operation in response to insertion of the new developing device. However, a user may turn off the power to the image forming apparatus before the initializing operation is complete. When power is restored, it is not possible to perform the initializing operation.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an image forming apparatus which reliably performs the initializing operation.

It is another object of the present invention to provide an image forming apparatus which reliably determines whether a detachable developing device is new or used.

In accordance with the present invention, the above-stated objects are achieved by providing an image forming apparatus for forming an image on an image carrier by a developer. The apparatus includes a body, and a developing device detachably located within the body for developing the image on the image carrier. An initializing device initializes the apparatus, including the developing device, in response to the location of the developing device within the apparatus. A setting device sets the state of the developing device to a used state after the initializing device has completed initializing the apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and many of the attendant advantages of this invention will be readily appreciated as the invention becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the figures thereof and wherein;

FIG. **1** is a perspective view of a laser printer according to the present invention;

FIG. **2** is a perspective view of the laser printer when an operator lifts up a top cover of the printer shown in FIG. **1**;

FIG. **3** is a sectional view of the laser printer shown in FIG. **1**;

FIG. **4** is a local sectional view of the laser printer shown in FIG. **1**;

FIGS. **5** and **6** are side views of a principal part of the laser printer shown in FIG. **1**, with certain parts omitted; and

FIG. **7** is a flow chart illustrating the operation of detecting the state of the developing unit used in the laser printer shown in FIG. **1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. **1**, an image forming apparatus, such as a laser printer **11**, serves as an output device for a host computer (not shown). In response to a print command from the host computer, laser printer **11** forms an image on a paper sheet according to data supplied from the host computer and feeds the paper sheet out to the user via tray **19**.

Laser printer **11** includes a body **13** formed of an upper cover **15** and a lower frame **17**. Upper cover **15** covers part of the upper portion of body **13**. Upper cover **15** is mounted by a hinge to body **13** and may be opened away from frame **17** as shown in FIG. **2**. An output tray **19** is located on the other part of the upper portion of body **13** and receives the printed paper sheet output from the printer. Output tray **19** has a notch **19***a* located in the middle of the front end of output tray **19**. A supplemental tray **21** is located at notch **19***a* and can be withdrawn or retracted into the printer as needed in order to accommodate various sizes of paper sheets.

A control panel **23** is located on an end surface of body **13** adjacent output tray **19**. Control panel **23** includes switch **25** for choosing an operating mode for the printer. Control panel **23** includes a plurality of visual displays, such as status indicator **27** and number indicator **29**. Status indicator **27** indicates the operating status of the printer via a plurality of light-emitting diodes. Number indicator **29** indicates the number of sheets

which have been printed, or, a print error code upon detection of a printing error. Paper supply cassette **31** is inserted into a lower portion of body **13**, located under output tray **19**. Hereinafter, the side of printer **11** into which cassette **31** is inserted will be referred to as the front side of the printer. Cassette **31** holds a supply of paper sheets P as shown in FIG. **3**. A manual feed tray **33** is inserted into the rear side of body **13**. Feed tray **33** is used as a guide for manually feeding individual paper sheets for printing. An I/O connector **35** is located on the left side surface of body **13**. A plug (not shown) for electrically connecting printer **11** to the host computer is inserted into I/O connector **35**. Body **13** includes an input port **37** for receiving programming cartridge or card **39** for automatically programming various print styles and fonts as is known in the prior art.

A power switch **41** is located on a side surface of body **13**. When power switch **41** is operated, electrical power is supplied to laser printer **11**.

Referring now to FIG. **3**, the internal construction of laser printer **11** will be described.

A main control board **101** is located near the center of body **13**. Control board **101** contains a CPU and related circuitry. An area **103** is located adjacent main control board **101** as shown in FIG. **3**. Area **103** provides space for a plurality of additional circuit boards, e.g., boards **105**, to be mated to control board **101**. In the present embodiment, area **103** can accommodate up to three additional circuit boards. Area **103** may also be enlarged to accommodate more circuit boards if necessary or made smaller if additional boards are needed. A connector **107** is located at the lowermost portion of area **103**. A programming cartridge or IC card may be plugged into connector **107** for programming special printer functions. Connector **107** is coupled to inlet **37** (See FIG. **1**). When an IC card **39**, for example, is inserted into inlet **37**, the card connects to connector **107** which in turn electrically connects the card to control board **101**. An interface connector (not shown) may be plugged into interface connector **35** in order to connect the printer to a host computer or such other devices which require printed images.

An image forming unit **109** is located to the right of control board **101** as shown in FIG. **3**. Image forming unit **109** forms an image on paper sheet **8**. According to the present invention, laser printer **11** employs an electrophotographic image forming technique.

Image forming unit **109** includes a photosensitive drum **111** for forming a latent image in response to light. Photosensitive drum **111** is rotated by an electric motor. A laser unit **113** radiates a laser beam in response to data supplied from a host computer so that a latent image is formed on the surface of drum **111**.

A developing unit **117** is located "down stream" along the rotational direction of photosensitive drum **111**. Developing unit **117** develops the latent image with a toner in order to generate a toner image and also cleans the surface of photosensitive drum **111** at the same time. A transferring unit **119** is located down stream of developing unit **117** along the rotational direction of photosensitive drum **111**. Transferring unit **119** transfers the toner image onto paper sheet **8** supplied from cassette **31**. A discharging unit **115** and a charging unit **116** are located up stream of laser unit **113** along the rotational direction of photosensitive drum **111**. Discharging unit **115** includes a lamp for radiating the surface of photosensitive drum **111** in order to set the electrical potential of the surface of photosensitive drum to a uniform level. After the electrical potential of the surface of the drum is set, charging unit **115** charges the entire surface of drum **111** in order to prepare the surface for forming a latent image.

A brush **121** is located down stream of transferring unit **119** along the rotational direction of photosensitive drum **111**. Brush **121** scrapes residual toner from the surface of photosensitive drum **111**.

Along with the operation of forming a latent image on drum **111**, paper sheet P is transported from cassette **31** or from manual feeding tray **3**. A pickup roller **151** in located at the top end of cassette **31** when cassette **31** is inserted into body **13** of the printer, as shown at the right side of body **13** in FIG. **3**. Pickup roller **151** has a cross-sectional shape of a half-moon, i.e., roller **151** has a flat surface. When the flat surface of pickup roller **151** faces cassette **31**, pickup roller **151** is out of contact with paper sheet P. However, when the curved surface of pickup roller **151** faces cassette **31**, pickup roller **151** is in contact with paper sheet P which allows the roller to pick up a paper sheet during its rotation.

Paper sheet P, when picked up by roller **151** from cassette **31**, is transported to a position (hereinafter referred to as the image transferring position) at which transferring unit **119** faces photosensitive drum **111** through a pair of conveying roller **153**, a pair of aligning rollers **155** and a pair of conveying rollers **187**. The details of these rollers **153**, **155** and **157** will be described below.

In normal operation, paper sheet P comes from feeding tray **33**. However, when paper sheet P is fed manually, conveying rollers introduce paper sheet P to the image transferring position. Prior to setting paper sheet P on manual feeding tray **33**, the user may designate a manual feeding mode on control panel **23** which causes printer **11** to form the image on paper sheet P supplied from manual feeding tray **33**. In response to the selection of the manual feeding mode or the cassette tray mode, the CPU controls the operation of image forming unit **109** accordingly. Note that paper sheet P is fed from cassette **31** synchronously with the image forming operation in the cassette tray mode in which paper sheet P is automatically supplied from cassette **31**.

Paper sheet P is transported from cassette **31** or manual feeding tray **33** to output tray **19**. A fixing unit **159** is located at the down stream end to the transferring position. Fixing unit **159** fixes the toner image onto paper sheet P by heating and pressing paper sheet P with the toner image.

A pair of eject rollers **161** is located at a further down stream position to fixing unit **159**. Eject rollers **161** eject paper sheet P with the fixed toner image onto receiving tray **33**.

Guide **163** is located between the transferring position and fixing unit **159**. Guide **163** is made from metal and is electrically grounded to printer **11**. During the image forming operation, guide **163** faces a side surface (hereinafter referred to as a non-image surface) of paper sheet P, on which there is no toner image. Thus, guide **163** electrostatically attracts paper sheet P toward guide **163** without disturbing the toner image on the back surface of paper sheet P.

A discharging brush **165** is located at a down stream position to eject rollers **161**. Discharging brush **165** is brought into contract with the non-image surface of paper sheet P immediately after eject rollers **161** ejects paper sheet P into output tray **19** with the toner image.

Upper cover **15** is pivotally fixed to body **13** through an axis **161** located at an upper portion of the rear side of body **13**. Upper cover **15** can be separated from body **13** as shown in FIG. **2**. Upper cover **15** includes transferring unit **119**, guide **163**, an upper roller of the pair of eject rollers **161** and discharging brush **165**. When upper cover **15** is separated from body **13**, the paper sheet path from conveying rollers **183** to eject rollers **161** is exposed to allow the clearing of misfeeds and jams.

Referring now to FIG. **4**, the detail of image forming unit **109** will be explained.

Laser unit **113** includes a semiconductor laser **201** for generating a laser beam in response to data supplied from the host computer. A mirror, such as a polygon mirror **203**, reflects the laser beam so that the laser beam scans the surface of photosensitive drum **111** through a first and a second lens **205** and **207** and first and second mirrors **209** and **211**. The detail of laser unit **113**, especially, first and second lens **205** and **207**, i.e., FO lens, is disclosed in U.S. patent application Ser. No. 454,947 filed Dec. 22, 1989, which is herein incorporated by reference. Laser unit **113** is mounted in casing **213** made of synthetic resin. A metallic shielding board **215** is used to cover an opening located at the base of casing **213**. Metallic shielding board **215** is detachably fixed to the opening. A metal shield cover **217** is located at the top surface of casing **213**. Shield cover **217** is coupled to a conductive strip **219**. As described below, a process cartridge, including developing unit **117**, is detachably inserted into body **13**. When developing unit **117** is inserted into body **13**, conductive strip **219** is brought into contact with a metallic guide rail for guiding developing unit **117** into body **13**. The above construction of casing **213** prevents static electricity generated during the image forming operation from affecting various components in laser unit **113**, e.g., semiconductor laser **201**.

Photosensitive drum **111** has first and second layers located on an aluminum tube. The first layer, located on the surface of the aluminum tube, generates a plurality of carriers in response to the laser light generated by laser unit **113**. The second layer, located on the first layer, transports the carriers generated in the first layer. The operation of drum **111** is disclosed in U.S. Pat. No. 4,722,879 which is herein incorporated by reference.

The operation of developing unit **117** will now be explained. Developing unit **117** includes a container **221** which contains a two-element developer comprising a toner and a toner carrier. The developer may be formed of a magnetic powder therein. Container **221** includes first and second stirrers **223** and **225** for mixing the toner and the toner carrier together.

Developing roller **227** transports the mixture of toner and toner carrier to a developing position facing the surface of photosensitive drum **111**. Developing roller **227** includes a magnetic roller **229** with a plurality of magnetic poles, e.g., first, second, and third magnetic poles **231**, **233**, and **235**. An angle O_2 between first and second magnetic poles **231** and **233** is 150 degrees. An angle O_2 between first and third magnetic poles **231** and **235** is 120 degrees. First pole **231**, is a N-pole facing the developing position. Second and third poles **233** and **235** are S-poles.

A non-magnetic sleeve **237** is slipped over the periphery of magnetic roller **228**. Non-magnetic sleeve **237** is rotated while magnetic roller **229** is fixed.

In the present embodiment, laser printer **11** employs a reverse development process and uses a two-component development agent. It is unnecessary to clean the surface of drum **111** before the next image formation. The detail of this mechanism is disclosed in U.S. Pat. No. 4,004,504, which is incorporated herein by reference.

Photosensitive drum **11**, charging unit **116**, developing unit **117** and brush **121** are mounted in a process cartridge **239** as one body. Process cartridge **239** is detachably inserted into body **13**. A cleaning brush **241**, located on the top surface of process cartridge **239**, is brought into contact with a lower aligning roller **155***b* of the pair of aligning rollers **155** in order to clean the surface of lower aligning roller **155***b*.

Fixing unit **159** comprises a heat roller **241** which includes heating element **243** for generating heat. A thermister **245** is in contact with the surface of heat roller **241** in order to detect the temperature of the surface of the heat roller. The detected temperature is used to control the temperature of the surface of heat roller **241** at a constant level. A cleaner **247** also is maintained in contact with the surface of heat roller **241** in order to keep the surface of heat roller **241** clean.

Fixing unit **159** comprises a pressure roller **249** in contact with heat roller **241**. Paper sheet P with the toner image is conveyed between heat and pressure roller **241** and **249**, guided by a paper guide **251**. Paper guide **251** is located at an up stream position relative to paper sheet P so that the leading edge of paper sheet p is received between heat and pressure rollers **241** and **243**.

Image forming device **109** includes paper guides **253** and **255**. Paper guide **253** is located between transferring unit **119** and fixing unit **159** so that paper guide **253** can guide paper sheet P into fixing unit **159**. Paper guide **255** is located between fixing unit **159** and the pair of eject rollers **161** so that paper guide **255** can guide paper sheet P, with the toner image, between the pair of eject rollers **161**.

Image forming device **109** comprises a toner cartridge **257** which contains a plurality of toner. Container **221** is provided with toner in accordance with the consumption of toner in developing unit **117** as shown in FIG. **2**. A toner sensor detects the toner density of developing unit **117**. When the toner density detected by the toner sensor is less than a predetermined value, toner cartridge **257** supplies container **221** with toner in response to a toner request signal provided by the toner sensor. The predetermined value is determined on the basis of an initial value of the toner density in container **221** when process cartridge **239** is inserted in body **13**. Than is, after the toner and the toner carriers are mixed together, the toner sensor measures the toner density of container **221** on the basis of the magnetic characteristic of the mixture of toner and toner carriers. The density value is treated as an initial value of toner density. The initial value of density depends on each process cartridge **239**. The predetermined value is set at a third or fourth of the initial value as measured by the toner sensor. Therefore, each process cartridge **239** has its own predetermined value of toner density.

Before process cartridge **239** is inserted into body **13**, process cartridge **239** is normally left to sit for a long period of time waiting to be used. The toner sensor, on the basis of magnetic characteristics of the toner, may fail to correctly measure the toner density of process cartridge **239** which is left sitting for a long period time.

Therefore, it is necessary to re-mix the toner and toner carrier. The image forming device further comprises an ozone filter **259** for eliminating various unnecessary elements, such as ozone generated during the image forming operation.

The process of determining whether cartridge **239** is new or used will now be explained. The term "new" as used herein refers to a cartridge **239** which has never been used in laser printer **11**. Thus, the toner and toner carriers have not been mixed together. The term "Used" as used herein refers to a cartridge **239** which has been previously used and thus the toner and toner carriers have been mixed together.

Referring now to FIG. **5**, process cartridge **239** (See FIG. **4**) includes a small plate **301** fixed on the outer surface of cartridge **239**. Small plate **301** has a threaded hole therein. A screw **303** passes through the threaded hole and a first gear **305** is fixed near the end of screw **303**.

When process cartridge **239** is inserted and set at a predetermined position in laser printer **11**, first gear **305** engages with a second gear **307**. An axis **309** of upper roller **155***a* of aligning rollers **155** engages second gear **307**. Thus, second gear **307** is rotated along with upper roller **155***a*. In response to settlement of process cartridge **239**, CPU **401** causes motor **403** to rotate upper roller **155***a* through a third gear **311** and spring clutch **313**. Spring clutch **313** selectively transmits the rotational motion to roller **155***a* in response to the operation of a solenoid **315** which is controlled by CPU **401**.

At the time that process cartridge **239** (hereinafter referred to as a setting time) is set in the predetermined position in laser printer **11**, screw **303** triggers a detector, e.g., a microswitch **317**, fixed to body **13**. Detector **317** includes a rotatable arm **319** pulled by a spring toward screw **303**, i.e., in the direction indicated by the arrow A shown in FIG. **5**. At the setting time, first gear **305** is located to the right of second gear **307** such that first gear **305** engages second gear **307**. At this time, screw **303** pushes rotatable arm **319** so that microswitch **317** is turned "ON", indicating that process cartridge **239** has been inserted. Thus, screw **303** does not push rotatable arm **319** so that microswitch **317** is turned "OFF" which indicates that process cartridge **231** is "used".

The movement of screw **303** will now be explained. When solenoid **315** operates, motor **403** rotates roller **155***a* through third gear **311** and spring clutch **313**. In response to the rotation of roller **155***a*, second gear **307** is rotated. In response to the movement of second gear **307**, first gear **305** is rotated so that screw **303** is moved to the left. When screw **303** is moved to the left by a predetermined amount, rotatable arm **319** is separated from the detecting surface of microswitch **317** so that microswitch **317** is turned "OFF" as shown in FIG. **6**.

Referring now to FIG. **7**, the operation of detecting whether process cartridge **239**, especially how developing unit **117** is determined to be "new" or "used", is explained.

The user initially inserts process cartridge **239** into body **13** so that the cartridge is located at the predetermined position. The user then operates power switch **41** (step **1**).

CPU **401** detects whether process cartridge **239** is "new" (step **2**). That is, CPU **401** detects whether microswitch **317** is "ON". When a new process cartridge **239** is inserted into body **13**, microswitch **317** is turned "ON" as shown in FIG. **5**.

When microswitch **317** is "OFF", process cartridge **239** is determined to be "used" so that no initial operation is needed. The operation, therefore, ends (step **3**).

When microswitch **317** is "ON", CPU **401** performs an initial operation (step **4**). This operation initializes cartridge **239**, i.e., toner to mix the toner and the toner carriers together within container **221**.

First and second stirrers **223** and **225** are rotated for a predetermined time in order to mix the toner and toner carriers together. After mixing, the toner sensor measures the initial value of toner density in process cartridge **239**. The toner sensor provides a toner request signal to cause toner cartridge **257** to supply the toner to container **221** of process cartridge **239** when the toner density is less than the predetermined value determined on the basis of the initial value. During the initial operation described above, spring clutch **13** does not transmit the rotational motion of third gear **311** to roller **155***a*.

CPU **401** then detects whether the initial operation is complete (step **5**). If the initial operation is not complete, CPU **401** returns to step **2**. If the initial operation is completed, however, CPU **401** causes aligning rollers **155** to rotate (step **6**). Thus, CPU **401** turns on solenoid **315** so that spring clutch **313** can transmit the rotational motion of third gear **311** to roller **155***a*. As roller **155***a* is rotated by motor **403** through third gear **311** and spring clutch **313**, upper roller **155***a* of aligning rollers **155** is thus rotated along with first and second gears **305** and **307**. In response to the rotation of first gear **305**, screw **303** is screwed into small plate **301** which is fixed to process cartridge **239**. As screw **303** is screwed into small plate **301**, first gear **305** is moved to the left as shown in FIGS. **5** and **6**. When first gear **305** is moved to the left so that first gear **305** is located left of second gear **307**, second gear **307** cannot rotate first gear **305**. Thus, first gear **305** is stationary. At the same time, rotatable arm **319** is pivotally moved by a spring as shown in FIG. **6**. Thus, microswitch **317** is turned "OFF". CPU **401** detects the "OFF" condition of microswitch **317** and determines that process cartridge **239** has been "used" (step **7**). The operation of detecting the condition of process cartridge **239** is thus completed. If the power to printer **11** is turned off during the initial operation in step **2**, CPU **401** treat process cartridge **239** as being "new." This is because the condition of process cartridge **239** is set to "used" after completing the initial operation.

Other objects, features and advantages of the present invention will become apparent from the above detailed description. It should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustrations only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art.

What is claimed is:

1. An image forming apparatus for forming an image on an image carrier, said apparatus comprising:

image forming means for forming said image on said image carrier;

developing means for developing said image formed on said image carrier, wherein said developing means is formed of a mixture of toner and toner carriers;

mixing means for mixing said toner and said toner carriers to form said mixture;

detecting means for detecting whether said toner and said toner carriers have been mixed together, and

means for setting the state of said developing means to a used state in response to the detecting result by said detecting means.

2. An image forming apparatus for forming an image on an image carrier by a developer, the apparatus comprising:

a body;

developing means, detachably located in the body, for developing the image on the image carrier by the developer;

initializing means for initializing the apparatus including the developing means in response to the location of the developing means within the apparatus; and

means for setting the state of the developing means to a used state after the initializing means has completed initializing the apparatus including the developing means, the setting means including,

a screw device,

moving means for moving said screw device,

detecting means for detecting whether said screw device is located in a predetermined position,

prohibiting means for prohibiting the moving means from moving said screw device while the initializing means initializes said apparatus, and

state setting means for changing the state of said developing means from new to used in response to the detection by said detecting means.

3. An image forming apparatus for forming an image on a recording medium, said apparatus comprising:

photosensitive surface means for forming said image;

image forming means for forming said image or said photosensitive surface means;

developing means for developing said image formed on said image forming means, wherein said developing means is formed of a mixture of toner and toner carriers and mixing means for mixing said toner and said toner carriers together to form said mixture;

transfer means for transferring a developed image from said photosensitive surface to said recording medium; and

indicating means for indicating whether said toner and said toner carriers have been mixed together, said indicating means being formed of a displacement marker and displacement marker drive means for driving said displacement marker to a first predetermined position when said toner said toner carriers have not been mixed together and a second predetermined position when said toner and said toner carriers have been mixed together.

4. The apparatus of claim 3, wherein said displacement marker drive means is formed of gear means.

5. The apparatus of claim 4 wherein said displacement marker drive means is formed of a driven gear driven by a drive gear, said driven gear being in driving engagement with said drive gear when said toner and said toner carriers have not been mixed.

6. The apparatus of claim 5 wherein said driven gear is out of driving engagement with said drive gear when said toner and said toner carriers have been mixed.

7. The apparatus of claim 6 wherein said indicating means further includes switch means for indicating the position of said displacement marker means.

8. The apparatus of claim 7 wherein said driven gear is coupled to shaft means, said shaft means being used to operate said switch means.

9. The apparatus of claim 8 wherein said shaft means is a screw.

10. The apparatus of claim 9 wherein said screw is threadedly received within stationary means.

11. The apparatus of claim 10 wherein the movement of said screw through said stationary means causes said driven gear to be in and out of engagement with said drive gear.

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